Intermittent Claudication

What it is and isn't

JACK A. CANNON, M.D., *Los Angeles*

THE DEVELOPMENT of effective direct arterial surgical techniques for obliterative atherosclerosis during the past 15 years has made more important than ever the correct interpretation of symptoms involving intermittent discomfort in the lower extremities in order that a diagnosis be made and the selection of patients for direct arterial operation properly carried out.

There remains a tendency to recognize intermittent claudication only when a patient complains of pain in one or both calf muscles on walking and examination shows an absence of the dorsalis pedis pulse. In such an instance a diagnosis of "Buerger's disease" is frequently made and treatment consists mainly of cautioning the patient to stop smoking and starting him on a trial of one of the many usually ineffective vasodilating drugs. On the other hand, a patient who complains of pain, weakness or numbness in one or both buttocks with extension into the thigh and brought on by walking is frequently still looked upon as having a "back problem" and is referred to an orthopedist or neurosurgeon for consultation. Not infrequently such a patient may have extensive x-ray studies including myelography, and sometimes may even have laminectomy before the diminished or absent common femoral pulse in the groin is recognized and a diagnosis made.

By employing standard techniques of physical diagnosis, it is possible to recognize symptomatic stenotic or obliterative arterial disease in any area of the arterial tree and to make at least a preliminary evaluation of the condition. Of primary importance in the early recognition of such ischemic problems is the ability to elicit and recognize symptoms of intermittent claudication in obtaining the case history. The purpose of this paper is to discuss the manifestations of intermittent claudication as they correlate with the physical findings and the pathologic conditions observed at operation in a given problem involving the arterial circulation to the lower extremities.

Definition

The term claudication is derived from the Latin verb *claudicare*, to limp. Hence, intermittent claudication means intermittent limping. Gould's medical dictionary defines the term as follows: "Cramplike pains and weakness in the legs, particularly the calves; induced by walking and relieved by rest, associated with excessive smoking, vascular spasm, and arteriosclerosis." In the light of present knowledge and usage of the term, this definition is too restrictive. Certainly intermittent claudication in the preponderance of instances is caused by obliterative or stenotic atherosclerosis. However, it may also occur as a sequel to embolic phenomena, as a consequence of trauma (including surgical trauma), as part of the manifestation of the rarely seen true Buerger's disease or thromboangiitis obliterans, and occasionally as part of the symptom complex seen in vasomotor disorders producing vasospasm. Nevertheless, the common denominator producing the intermittent claudication in these diseases is a

From the Department of Surgery, University of California at Los Angeles, School of Medicine and the Center for the Health Services, Los Angeles.

Supported in part by a grant from the U.S. Public Health Service, HE 01787.

Submitted February 8, 1965.

condition of relative muscular ischemia. Thus, claudication occurs only with muscle exercise and appears when the muscle being exercised becomes relatively ischemic. Rest of the muscle automatically lowers its arterial circulatory requirement and the discomfort disappears as the relative ischemia is relieved.

It is true that intermittent claudication is most often seen in the calf muscles but it must be remembered that the symptom can occur in any muscle or muscle group involved in lower extremity locomotion which becomes relatively ischemic during exercise. The condition, indeed, can occur in normal extremities if the exercise tolerance is exceeded. Much can be surmised as to the diagnosis and the arterial segment or segments involved by carefully noting what muscle groups are involved in claudication.

Case Presentations and Analysis

In an attempt to confirm the premise that ischemic problems in the lower extremity can be recognized and localized by history and physical examination alone, a few selected cases will be briefly presented and the findings discussed.

CASE 1. A 65-year-old man was seen in consultation with complaint of the onset of pain in the right calf muscle on walking two blocks at a normal pace. The difficulty was relatively sudden in onset and had troubled him for the preceding six months. Attempting to continue walking after onset of pain caused it to increase forcing him to halt. Only the muscles of the right calf hurt. The patient found that with onset of the pain while walking, the difficulty would invariably disappear if he halted for a few moments, after which he could again proceed two blocks or more before recurrence. He denied other symptoms. He was comfortable at rest or in walking about his shop during the day and had no trouble in the extremity at night.

On examination the patient appeared healthy and looked his stated age. Blood pressure was within normal range and no abnormalities of the heart or lungs were noted. Positive findings were limited to the lower extremities. Common femoral arterial pulses at the groins over the inguinal ligaments were normal. The right popliteal pulse was absent, the left was 2-plus (normal 4-plus). The right pedal pulses were absent. The left posterior tibial pulse was weak and the dorsalis pedis pulse absent. Oscillometry at the calves revealed a 1-1-½ division needles swing on the right and a 2-3 divisions swing on the left. Elevation of the extremities revealed slight blanching in the right foot, none on the left. Dependency of the extremities after elevation revealed filling of the foot veins on the right after 35 seconds (slightly delayed) and within 20 seconds on the left.

Discussion: From the history and physical examination it can be predicted that arteriography in this patient will reveal patency in the aortoiliac segments of the arterial tree. On the right there will be complete obstruction of the femoropopliteal arterial junction with evidence of geniculate collateral formation and distal patency in the popliteal artery and portions at least of its distal branches. On the left there will be stenotic narrowing at the femoropopliteal junction with evidence of plaquing proximal and distal and occlusion of the anterior tibial artery at its orifice. The diagnosis is atherosclerotic femoropopliteal obliterative disease with complete occlusion of the right femoropopliteal arterial segment, and stenosis on the left.

CASE 2. A 67-year-old man sought consultation because of onset of pain in the right calf muscle on walking two and a half to three blocks. The condition had existed for 12 years. If he forced himself to continue walking after onset of right calf pain, the left calf became painful and pain then extended up both thighs and into the hips. At this point he was forced to stop walking because of pain. With a few minutes of rest, standing still, all pain disappeared. The patient appeared healthy and looked his stated age. Blood pressure was 165/90 mm of mercury. The heart and lungs were clear. Positive findings were limited to the arterial system of the lower extremities. The abdominal aortic pulse was easily palpable, but pulsations ended about 2 cm above the umbilicus. A very soft systolic bruit was audible over the umbilicus and over the left groin but not the right. A 1-plus pulse was palpable over the left common femoral artery and a barely detectable pulse was present at the right common femoral artery. The right lower extremity was pulseless below this level. In the lower left extremity, a barely detectable popliteal pulse, a 1-plus posterior tibial pulse and absence of dorsalis pedis pulse were noted. Oscillometry at the calves revealed no motion of the needle on the right and 1-1-½ divisions of oscillation on the left. Both feet showed blanching on elevation but vein filling occurred within 20 seconds in both on dependency.

Discussion: This patient had atherosclerotic aortoiliac obliterative disease, complete on the right and nearly complete on the left. In addition, almost certainly there was femoropopliteal involvement bilaterally, worse on the right. The salient features in the history and physical examination leading to this conclusion were: Onset of pain in the right calf, then also of the left, indicating femoropopliteal involvement, worse on the right. Spread of the pain to the thighs and buttocks, worse on the right, in-

dicates aortoiliac involvement. The pulse at the right groin without a bruit arises from collateral circulation around the totally obstructed common iliac artery. The pulse at the left groin with bruit arises from the severely stenosed aortoiliac segment plus some collateral.

CASE 3. A 46-year-old postman sought consultation because in the past 18 months he had had increasing difficulty in walking his route and finally had to request assignment to work not involving walking. Increasingly since the onset of symptoms, walking resulted in a progressive feeling of tiredness and weakness in all the muscles from the hips down the thighs and calves to the feet. He was perfectly comfortable at rest or on walking no more than one or two blocks although the distress appeared much more quickly walking uphill or climbing stairs. The symptoms invariably disappeared with a few moments of rest. He denied actual pain except for occasional aching in the buttocks on walking more than a block. He described his symptoms more as a tired, weak "giving out" feeling in his lower extremities which occurred on walking. Occasionally at night he would awaken with numbness in one or both legs which he could avoid by not sleeping on his back. On driving significant distances he tended to develop numbness in the right leg and calf which he would relieve by shifting his position or by stopping and walking about. He also complained of increasing inability to obtain and maintain an erection during intercourse. In previous orthopedic and neurosurgical consultations, x-ray studies of the lumbar spine, lumbar puncture and myelography had shown no abnormalities and no sensory or motor deficits were reported.

On examination the patient appeared healthy but it was noted that the hips, thighs and calves were thin compared with torso and upper extremities. Blood pressure was 120/80 mm of mercury. The heart and lungs were clear. The abdominal aorta was palpable in the epigastrium with the pulsations ending above the level of the umbilicus. A systolic bruit was heard over the umbilicus and both groins. Pulses in both extremities were palpable but diminished to 1-1-½+. Oscillometry at both calves was 1-½-2 divisions.

Discussion: Such a patient has a true Leriche syndrome, that is, atherosclerotic occlusion of the terminal aorta. He suffers intermittent claudication of the lower one-half of his body. The ischemia is symmetrically distributed. The symptoms are weakness and tiredness of all the muscles of locomotion that are supplied by the terminal branches of the abdominal aorta. The distal tree is patent as demonstrated by the presence of distal although diminished pulses. It is to be emphasized that these symptoms occur only with muscle exercise, with the exception of the numbness occurring occasionally while sitting or lying which probably results from occlusive pressure occurring to the collateral network in the buttocks. Such a patient is very likely to be benefited by direct arterial operation.

CASE 4. A 28-year-old man complained of severe pain in his feet on walking. He had first noted the discomfort about three and a half years before while on a hike in the mountains. He found difficulty in keeping up with his companions because of pain in his feet which forced him to rest every few minutes. The difficulty had gradually progressed. At first he thought he obtained some relief by wearing shoes a half-size larger than usual. He finally consulted an orthopedist, who prescribed special shoes with built-in arch supports. He found no real relief with the shoes and when first seen in consultation he stated that he could walk no more than a half block before being halted by pain in the feet. He described the pain as cramping or aching and said it appeared only on walking. First the balls of the feet were affected, then the arch; lately the pain had begun to extend upward into the ankle and lower calf. The pain was always relieved by resting, more rapidly if he could sit down. He lately had begun to be occasionally awakened at night by a burning numbness in the toes and forefoot on the right which he could only relieve by getting up and walking about a few moments. He said that he had smoked cigarettes since high school, averaging one package per day.

The patient appeared healthy and seemed to be in no acute distress. No abnormalities were noted on general physical examination except in the lower extremities. Common femoral and popliteal pulses were present and within normal limits. No bruits were heard over the common femoral pulses in the groins. Oscillometry at the calves revealed a 2 division needle oscillation on the right and a 3 division oscillation on the left. Posterior tibial and dorsalis pedis pulses could not be palpated in either foot. The feet showed abnormal blanching, especially of the forefoot on elevation. Filling of the veins on the dorsum of the foot appeared after 50 seconds after depending on the left and 65 seconds on the right. Dependent rubor developed in the toes and dorsum of the feet within two and a half minutes. With the extremities horizontal capillary filling after digital pressure to produce blanching at the tips of the toes was significantly delayed.

Discussion: This patient had classical Buerger's disease or thromboangiitis obliterans, which is very rare. Diagnosis of this condition can be made fairly positive from the history alone. The typical patient has claudication in the feet. He is young. He smokes. Popliteal pulses are present but oscillo-

metric readings are far below normal. Pedal pulses are absent and signs of distal ischemia are present. The patient is beginning to have rest pain in the more ischemic foot. Similar findings are seen occasionally only in young persons with diabetes but in this condition the diabetes will almost always have been long since diagnosed.

CASE 5. A 66-year-old sorority housemother was referred for consultation because of increasing numbness and weakness in the feet for the preceding three years. For the previous several months she had been under the care of a physician who told her the circulation in her lower extremities was poor and treated her with a variety of vasodilating drugs, including Papaverine, Vasodilan and Cyclospasmol, with no improvement. Her symptoms worsened and when seen she complained that walking, sometimes only four or five steps, sometimes up to one-half block, caused pain in both lower extremities, beginning in the hips and extending downward. Her ankles and legs would then become uncomfortable, stiff and numb. If she tried to continue walking she seemed to lose control of her feet and would begin to stagger. She would then have to sit down. She said that on one occasion when almost to the point of having to stop walking she stooped over to pick up her purse and then found that she could go on walking again. At the time of the consultation she was in a state of agitated depression because she could no longer perform her work satisfactorily and had been given notice of dismissal.

On examination she seemed well developed but undernourished and she appeared somewhat older than her given age. Definitely positive findings were surprisingly meager. Movement of the head was limited in all directions. Scoliosis of the thoracic spine was noted and there was winging of the scapulae. In the lower extremities there was decreased discernment of vibration from the level of the iliac crest to the toes. Knee jerks and ankle jerks were hyperactive. All arterial pulses were present and easily palpable except for the dorsalis pedis pulses which, although present, were difficult to palpate. Oscillometry at both calves was a normal 4-6 divisions. The feet were cool but capillary filling was adequate.

Discussion: Thoughtful consideration of the history in this case indicates that the symptoms cannot be due to arterial ischemia, for in that condition claudication does not occur in distances which vary from a few steps to a half block. Lower extremity ischemia does not cause staggering and almost invariably will disappear as quickly with the patient standing still as it will if the patient sits down. It is never quickly relieved by a change in posture during exercise. The dorsalis pedis pulse is the most difficult pulse to palpate in the normal state. It is frequently absent in patients who are asymptomatic. It is more often absent than present in women who tend to have cold hands and feet. Intermittent claudication does not occur in the absence of at least a diminution of a major pulse to the symptomatic part and certainly is not seen in the presence of normal calf oscillometry.

In this case the history and the fact that no abnormalities were noted on vascular examination indicated the possibility of neurological disease. After neurosurgical consultation, x-ray films of the cervical spine demonstrated a Klippel-Feil deformity with anterior subluxation of the fourth cervical vertebra on the fifth in extension. An air myelogram demonstrated encroachment upon the cord by the lamina of the fourth vertebra with the head flexed and by the body of the fifth with the head extended. Removal of the disc between them and fusion of the fourth and fifth cervical vertebrae resulted in remarkable improvement in the patient's limitation of ambulation.

CASE 6. A 70-year-old man, a retired office worker, was seen in consultation because of pain in the right lower extremity, made worse by walking. Symptoms had begun suddenly three months previously when he awakened with a numb and tingling sensation along the lateral aspect of the right leg and foot. On standing he noted pain in the right hip and thigh which became worse with walking. The pain was relieved only if he sat or lay down for a few minutes. Over the course of the next three months the symptoms increased in severity and the left lower extremity became similarly but not as severely involved. The patient said that he was fairly comfortable in bed; pain appeared when he stood up. It became so intense in the right hip, thigh and calf and to a lesser degree in the left thigh and calf after walking a few steps that he had to sit down. He obtained no relief from standing still. In the recent past he found that he could no longer stand long enough to shave because on onset of the pain.

The patient was somewhat underweight and he walked with a slight stoop and a limp, favoring the right lower extremity. On general physical examination the following abnormalities were observed: Ankle jerks were diminished bilaterally. Vibratory sense was diminished throughout both lower extremities. There was some impairment of sensation in both lower extremities but without a definite pattern. The abdominal aorta was easily palpable but systolic bruit was heard over the umbilicus and over both groins, louder on the left. The left common femoral, popliteal and posterior pedis pulse were absent. Pulses were easily palpable and within normal limits in the right lower ex-

tremity. Oscillometry at the left calf was 2 divisions, at the right 4 to 5 divisions, compared with a normal of 5 to 7 in males. Results of elevation and dependency tests of the feet were within normal limits. The impression of the referring neurosurgeon was that the predominant difficulty was due to obliterative vascular disease.

Discussion: This patient did not exhibit true claudication. True, his lower extremity symptoms became worse with walking; but, significantly, they also became worse with merely standing. Furthermore, relief could only be obtained if he sat down or preferably lay down. Both neurological and vascular abnormalities were present, but it is to be noted that the pulse deficit was present in the less symptomatic lower extremity. Spinal myelography was suggested and a large filling defect on both sides at the level of the fourth and fifth lumbar vertebrae was seen. Subsequent laminectomy and removal of a large herniated intervertebral disc resulted in ultimate complete relief of pain. Subsequent walks up to four blocks in length caused no discomfort in either lower extremity in spite of left-sided iliac stenotic atherosclerosis.

It is obvious that this patient had stenotic aortoiliac atherosclerosis but it was not contributory to the symptoms.

CASE 7. A 53-year-old housewife was seen in consultation because of numbness, weakness and fatigue of six months' duration in both lower extremities. She said that onset had been rather sudden while she was housecleaning. She said she had had no actual pain at any time but that since the onset of the symptoms her feet had become cold and the skin of her legs bluish and somewhat mottled. She subsequently found that on walking about a half block the feet and legs would become numb and a feeling of exhaustion and muscle weakness of the entire lower half of her body developed, including the lower back, the hips and both lower extremities. She said at such times she was sure she would fall if she tried to take another step, then, after standing still for a few moments she could again walk a short distance. At home she found that she could not climb one flight of stairs without resting at least three times.

The patient said that all her adult life she had been subject to easy fatigue and dyspnea on exertion. She had been told she had "a heart murmur" but had never been given a drug for that condition. She had never noticed edema at the ankles.

On examination, percussion indicated probable cardiac enlargement, and a soft, blowing presystolic murmur was heard over the mitral area. The abdominal aorta could be palpated in the epigastrium, but its pulsation ended about 4 cm above the umbilicus. Very weak common femoral pulses could be palpated but no bruits were heard at the umbilicus or groins. The extremities were pulseless below this level. Oscillometry at the calves revealed a slight movement of the needle—only one-quarter to one-half of a division. The lower extremities were cool, the toes were slightly cyanotic and the skin of the legs and thighs showed a bluish mottling. There was no sensory impairment and reflexes were intact.

Discussion: The history in this case would suggest neurologic involvement unless proper value is given to the fact that the patient is comfortable at rest except for coldness of the lower extremities. Furthermore, the symptoms are brought on only by exercise and are relieved by rest. Physical findings indicate complete obstruction of the terminal aorta with lower extremity circulation maintained by collateral vessels. The cardiac findings are consistent with longstanding mitral stenosis.

At operation this patient was found to have an organized clot almost certainly of embolic origin obstructing the terminal aorta and common iliac arteries. There was no evidence of significant atherosclerosis and the distal arterial tree was clear. Normal pulses were restored by aortoiliac endarterectomy and the lower extremity symptoms were completely relieved.

It is to be emphasized that claudication, especially of aortic origin, need not necessarily include actual muscle pain as part of the symptom complex. Obviously a saddle embolus to the terminal aorta does not always result in acute ischemia progressing to gangrene of the feet and legs.

Summary and Conclusions

Intermitten claudication is caused by relative ischemia of the muscles of the affected part. It appears only with exercise of such muscles and disappears with rest. Symptoms may include pain, numbness and weakness and may be confused with similar symptoms of neural or arthritic origin. The level of relative ischemia can be detected by careful palpation of pulses, auscultation for bruits and inspection, as well as attention to the location of symptoms as brought out by a careful history.

Department of Surgery, UCLA School of Medicine, Los Angeles, California 90024.